BMJ Open

Information and communication technology-based interventions for suicide prevention implemented in clinical settings: A scoping review protocol

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-056232
Article Type:	Protocol
Date Submitted by the Author:	08-Aug-2021
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Keywords:	Suicide & self-harm < PSYCHIATRY, Information technology < BIOTECHNOLOGY & BIOINFORMATICS, MENTAL HEALTH

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1   **Information and communication technology-based interventions for suicide prevention**
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2   **implemented in clinical settings: A scoping review protocol**
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28

29   *Conflicts of Interest*

30   There are no conflicts of interest to declare with this submission.

31

32   *Word count*

33   2938

34   *Funding*

35   No funding was received for this review.

36

37   *Contributors*

38   HDS designed the scoping review protocol including data collection and interpretation planning.

39   HDS drafted the protocol. TL is a librarian and revised methods for search strategy and

40   developed final search strategy. HDS, JJ, TL, JT, GS revised the protocol for intellectual content

41   and made a final approval for the submission of the protocol.

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42   **Information and communication technology-based interventions for suicide prevention**

43   **implemented in clinical settings: A scoping review protocol**

44   **Abstract**

45   **Introduction**

46   There is a surplus of Information and Communication Technology (ICT)-based interventions for

47   suicide prevention. However, it is unclear which of these ICT-based interventions for suicide

48   prevention have been implemented in clinical settings. Furthermore, evidence shows that

49   implementation strategies have often been mismatched to existing barriers. In response, the

50   authors recognize the critical need for prospectively assessing the barriers and facilitators and

51   then strategically developing implementation strategies. This review is part of a multi-phase

52   project to develop and test tailored implementation strategies for mobile app-based suicide

53   prevention in clinical settings. The overall objective of this scoping review is to identify and

54   characterize ICT-based interventions for all levels of suicide prevention in clinical settings.

55   Additionally, this review will identify and characterize the barriers and facilitators to

56   implementing these ICT-based interventions as well as reported measures and outcomes. The

57   findings will directly inform the subsequent phase to maximize implementation and inform

58 future efforts for implementing other types of ICT-based interventions related to suicide

59 prevention in clinical settings.

Methods and Analysis

61 This review will adhere to the methods described by the Joanna Briggs Institute for conducting

62 scoping reviews. The reporting will follow the Preferred Reporting Items for Systematic

63 Reviews and Meta-Analysis extension for scoping reviews checklist. The following databases

64 will be searched: Medline, PsycInfo, Embase, CINAHL, Web of Science, and LISTA. Two

65 reviewers will independently screen the articles and extract data using a standardised data

66 collection tool. Then, authors will characterize extracted data using frameworks, typology, and

67 taxonomies to address the proposed review questions.

Ethics and Dissemination

69 Ethics approval is not required for this scoping review. Authors will share the results in a peer-

70 reviewed, open access publication, and conference presentations. Furthermore, the findings will

71 be shared with relevant health organizations through lay language summaries and informal

72 presentations.

73 **Strengths and Limitations of this study**

74 • A rigorous scoping review method described by the Joanna Briggs Institute will be followed

75 and the full report will be developed using the Preferred Reporting Items for Systematic

76 Reviews and Meta-Analysis extension for scoping reviews checklist.

77 • This will be the first scoping review to map out the clinician-reported barriers and

78 facilitators to implement ICT-based interventions for suicide prevention in clinical settings.

79 • This scoping review has limitations regarding the number of databases and non-English

80 publication languages, which may limit research from low income and middle-income

81 countries.

82 • The list of barriers and facilitators will be limited to what is reported in the existing

83 literature; therefore, the research team aims to conduct a follow-up qualitative research to

84 better investigate and contextualize barriers and facilitators in a specific clinical context.

85 • Since the purpose of this scoping review is to map and characterize the evidence, there will

86 not be critical appraisals to determine the quality of individual studies to assess the risk of

87 bias.

88   **Introduction**

89   Globally, 800,000 people die by suicide every year, which translates to 11 deaths per

90   day.[1] In Canada, suicide is currently the second leading cause of death among youth and young

91   adults.[2] Furthermore, the service utilization for those experiencing suicidal thoughts and

92   behaviours has been increasing for many years. At a national level, the number of emergency

93   department visits related to suicide-related thoughts and behaviours has doubled among youth

94   between 2007 to 2015 in the USA.[3] Similarly, in Australia, the numbers have tripled among

95   patients of all ages from 2009 to 2018 in two emergency departments.[4] Suicide prevention is a

96   top research priority globally, as reflected in the United Nations Sustainable Development Goals

97   for 2030.[5]

98   The current COVID-19 pandemic has brought a significant impact on psychological

99   health, further contributing to the increased need for suicide prevention services.[6] Furthermore,

100   there has been poorer access to mental health services since the onset of pandemic.[7] One

101   recommendation to meet this unprecedented, increased need for mental health care is to reform

102   the system and re-distribute services and resources from tertiary care centres to community and

103   primary care.[8] Technological integration between primary, community and tertiary mental health

104   is one adaptable response.[9] For example, innovative tools, such as telehealth tools, have been

105   rapidly implemented in community mental health services internationally, allowing continuity of

106   care.[7] As such, COVID-19 pandemic has accelerated the implementation of digital solutions,[10]

107   and this momentum can be leveraged to re-distribute mental health care via innovative means to

108   provide appropriate suicide prevention care to patients at the right time.

109   Information and communication technology (ICT) is defined as "a set of technologies

110   resulting from the convergence of information technology and advanced multimedia and

111   telecommunications techniques, which have enabled the emergence of more efficient means of

112   communication, by improving processing, storage, distribution and exchange some

113   information."[11] ICTs are also referred to as eHealth by the World Health Organization (WHO),[12]

114   and examples include, but are not limited to, Internet and mobile technologies. There is a surplus

115   of ICT-based interventions for mental health care, including suicide prevention.[13,14] For example,

116   there are 38 mental health apps available from the Google Play Store (Android) and Apple App

117   Store, and 11 of them are comprised of in-app crisis resources such as safety planning

118   intervention (SPI).[15] Rassy and colleagues[14] have shown that ICTs for suicide prevention can

119   provide an interactive, personalized, and accessible way to reach various populations to identify

120 and provide care to the individuals at risk.[14] Although more additional higher quality,

121 randomized controlled studies are required, evidence to date shows promising outcomes of the

122 ICT-based interventions for suicide prevention, including high acceptability from the patients

123 and some beneficial effects on suicidal ideation.[16] In clinical settings, on the other hand, it

124 remains unknown which ICT-based interventions for suicide prevention have been implemented

125 and are being delivered by clinicians.

126 As of now, the SPI[17] is one best practice for suicide prevention, producing a 45%

127 reduction in suicidal behaviour compared to treatment as usual in the emergency department.[18]

128 More recently, systematic reviews have shown significant effects of SPI on reducing the risk of

129 suicide-related behaviours.[19,20] SPI is a collaborative process between clinicians and a patient for

130 developing a plan regarding coping strategies, emergency contacts, and lethal means

131 restriction.[17] As collaboration is a critical feature of SPI, clinicians play an important role in

132 creating a therapeutic alliance with patients and building trust. As such, ICTs cannot replace

133 clinicians in situations where clinical interaction is essential, yet ICTs can be embedded in

134 clinical settings to make effective interventions more widely accessible.[21] Furthermore,

135   integrating ICT-based interventions into routine care, which allows clinicians to provide

136   oversight to patients, can facilitate the adoption of these tools.[22]

137   To date, reviews have yet to comprehensively explore ICT-based interventions for

138   suicide prevention delivered in clinical settings. Furthermore, reviews have yet to assess barriers

139   and facilitators for implementing these ICT-based interventions for suicide prevention. Hence,

140   the overall objective of this scoping review is to identify and characterize ICT-based

141   interventions for all levels of suicide prevention in clinical settings. The secondary objectives of

142   this review are as follow: 1) identify and characterize the barriers and facilitators to

143   implementing these ICT-based interventions within the Capability, Opportunity, Motivation -

144   Behaviour (COM-B)[23] and the Theoretical Domains Framework (TDF)[24]; 2) identify reported

145   measures and outcomes in these studies.

146   This review is part of a multi-phase project to develop and test tailored implementation

147   strategies for mobile app-based suicide prevention in clinical settings. Implementation is a

148   known determinant of effectiveness, meaning barriers to implementation can significantly reduce

149   the effectiveness of interventions and lead to suboptimal outcomes.[25] Further, evidence shows

150   that implementation strategies have often been mismatched to existing barriers in a given

151 context.[26,27] For example, a review of 20 quality improvement studies found that many studies

152 utilized clinician-oriented (individual level) strategies, such as education, to address

153 organizational level barriers.[26] Theoretically speaking, education alone may be insufficient to

154 address external influences of implementation.[23] Specifically for mental health apps, there was a

155 recent call for attention to complex contexts in which apps are being implemented in order to

156 tailor facilitation.[28] As such, it is critical to prospectively assess the barriers and facilitators in the

157 organizational and local context and then strategically develop implementation strategies.[29] The

158 findings from this review will be used as a knowledge base for the subsequent phase to identify

159 strategies to overcome barriers and leverage facilitators to maximize implementation. The

160 findings can also inform future efforts to develop and test strategies for implementing other types

161 of ICT-based interventions related to suicide prevention in clinical settings.

162   A search of PROSPERO, the Cochrane Database of Systematic Reviews and Joanna

163 Briggs Institute (JBI) Evidence Synthesis and Open Science Framework was conducted in June-

164 July 2021, and no current or underway systematic reviews or scoping reviews on the topic were

165 identified.

Research questions

167   To achieve the research objectives stated above, this scoping review will address the following

168   questions.

169   1.   What ICT-based interventions for suicide prevention have been implemented in clinical

170   settings?

171   1.1. What are the reported barriers and facilitators to implementing these ICT-based

172   interventions?

173   1.2. What are the reported measures and outcomes?

174   **Methods**

175   This review will adhere to the JBI methodology for scoping review,[30,31] and the Preferred

176   Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA-ScR) extension for

177   scoping reviews[32] will be used to guide the reporting.

178   **Inclusion/exclusion criteria**

179   To identify relevant studies, key inclusion/exclusion criteria were constructed based on

180   the population, concept and context (PCC) mnemonic recommended by JBI. *Participant*

181   In literature, a wide range of health care professionals who provide direct care in clinical

182   settings (e.g., physicians, nurses, nurse practitioners, physician assistants, social workers, and

183   medical resident) have been commonly referred to as 'clinicians'.[33,34] All types of clinicians who

184   are licenced and regulated practitioners will be included in this review. Furthermore, unregulated

185   practitioners or clinical support personnel, such as peer support workers, will be included in this

186   review. Therefore, ICT-based interventions must be implemented or delivered by these members

187   of the clinical team, and this review will exclude studies if a research assistant delivers an ICT-

188   based intervention. There will be no exclusion criteria based on gender, health care discipline,

189   and years of experience. Therefore, health care trainees, such as medical residents, will also be

190   considered for inclusion. Lastly, ICT-based interventions can target patient population of any age

191   and any levels of suicide prevention.

192   *Concept*

193   All literature that describes ICT-based interventions will be included in this review.

194   Following the definitions provided in the introduction, ICTs or eHealth include, but are not

195   limited to, computerized resources, mobile apps, and text messaging. Additionally, the definition

196   provided by the WHO will be adopted to identify interventions: "A health intervention is an act

197 performed for, with or on behalf of a person or population whose purpose is to assess, improve,

198 maintain, promote or modify health, functioning or health conditions."[35] Therefore, general use

199 of electronic health care records while caring for patients with suicidal ideation will be excluded

200 if there are no ICT-based interventions being implemented or delivered to patients. Additionally,

201 routine care provided via virtual platforms or telephones will be excluded unless an ICT-based

202 intervention is being delivered. ICT-based interventions can be delivered in-person or other

203 means of communication by clinicians. Crisis services (phone, chat, text) as are appropriate

204 response for suicide prevention. However, this review will exclude crisis services since there has

205 already been a systematic review investigating their effectiveness.[36] The current review will use

206 the umbrella term, suicide-related thoughts and behaviours,[37] which refers to a spectrum of

207 suicide-related ideation, communication, behaviours, and attempts with having casual to

208 persistent suicidal thoughts with actual, undetermined or no suicidal intent. ICT-based

209 interventions for suicide prevention regarding any sub-category of suicide-related thoughts and

210 behaviours will be included. Lastly, ICT-based interventions related to all levels of suicide

211 prevention following the WHO description (i.e., Universal, Selective, Indicated)[38] will be

212 included.

213   *Context*

214   All types of clinical settings, such as in-patient, emergency, ambulatory, and primary care,

215   will be considered for inclusion. For this review, a clinical setting is defined as any context

216   where clinician-patient interactions occur in real-time. To be included, ICT-based interventions

217   need to be implemented and initiated in the clinical setting. Self-support tools that patients can

218   freely download from app stores will be excluded as these are being initiated in non-clinical

219   settings. However, if app-based interventions or other forms of ICT-based interventions are

220   prescribed by clinicians or clinical support team, they will be included in the review. Please see

221   Table 1 for the summary of eligibility.

222   **Table 1. Eligibility criteria**

	Inclusion Criteria	Exclusion Criteria
Population	All members of clinical care team • licenced and regulated practitioners • Unregulated practitioners or clinical support teams such as peer support workers All ages, genders, locations, and years of experience	Not a member of clinical care team

Topic	Information and Communication Technologies (ICTs): "A set of technologies resulting from the convergence of information technology and advanced multimedia and telecommunications techniques, which have enabled the emergence of more efficient means of communication, by improving processing, storage, distribution and exchange some information." [11] Suicide-related thoughts and behaviours[37]: represent a spectrum of suicide-related ideation, communication, behaviours and attempts with having casual to persistent suicidal thoughts with actual, undetermined or no suicidal intent. This review will consider ICT-based interventions for suicide prevention regarding any sub-category of suicide-related thoughts and behaviours.	No ICTs Crisis services (phone, chat, text)
Setting	Clinical setting or context (i.e., clinician-patient interaction in real time)	Not a clinical setting or context
Source	Primary research papers including in press papers. If literature reviews, commentaries, and opinion papers include relevant primary research studies, this review will include them in the screening phase then hand-search their references to identify the original papers that meet the inclusion criteria. Conference papers, reports from relevant health services organizations.	Books, theses, commentaries, opinion papers, literature reviews, preprints, abstracts

Type of study	All designs including study protocols	N/A
Language	English	non-English language

223 **Search strategy**

224   In collaboration with a health sciences librarian, a comprehensive search strategy will be

225 developed to locate relevant scholarly literature using multiple bibliographic databases. This

226 scoping review will follow a three-step search strategy outlined in JBI methodology.[31] First, we

227 will develop and refine a draft strategy in Medline, followed by an analysis of the text words

228 contained in titles and abstracts of relevant articles and the subject headings applied to them.

229 After revising, testing, and finalizing this search strategy, TR will translate the strategy using

230 database-specific subject headings, search fields, and operators, and run the search in each

231 included database. The search strategy will be peer-reviewed by a second research librarian using

232 the Peer Review of Electronic Search Strategy (PRESS) guidelines.[39] The proposed search

233 strategy for Medline (Ovid), peer-reviewed by a second research librarian, is presented in

234 Supplementary File II. Thirdly, the reference list of the sources that have been included in the

235 reviews will be hand-searched for additional articles.

236   The targeted Google search method outlined by Godin et al., 2015.[40] will be utilized to

237   identify a list of international and national health services' websites to locate reports and other

238   eligible sources. The first step involves conducting ten unique Google searches with different

239   combinations of keywords and reviewing the first 100 items of each search to identify relevant

240   websites. The second step involves hand-searching identified relevant websites to find reports or

241   other sources that meet the inclusion criteria. This targeted Google search will complement the

242   database searches to identify more diverse sources of evidence.

243   **Types of sources**

244   The following databases will be searched for relevant studies: Medline, APA PsycInfo,

245   Embase, the Cumulative Index to Nursing & Allied Health Literature (CINAHL), Web of

246   Science, and Library, Information Science & Technology Abstracts (LISTA). All types of

247   research designs will be included (e.g., quantitative, observational, qualitative, and mixed

248   methods). Reference lists of relevant literature reviews, commentaries, text and opinion papers

249   will be reviewed to identify additional primary research papers that meet the eligibility criteria.

250   Grey literature including conference papers, reports and publications by relevant national and

251 international websites of health organizations and agencies will be included. Sources written in

252 English will be included, and no date parameters will be applied.

Study selection

254   All identified citations will be collated and uploaded into Covidence[41] and duplicates will

255 be automatically removed. Two reviewers will independently screen titles and abstracts against

256 the inclusion and exclusion criteria. Next, relevant full-text articles will be retrieved into

257 Covidence,[41] and two independent reviewers will assess the full-text of relevant studies in detail

258 against the eligibility criteria. Reasons for exclusion will be recorded at the full-text screening

259 phase and will be reported in the full review. Any discrepancies between the reviewers at each

260 stage of the study selection process will be resolved either through discussion or by a third

261 reviewer. Scoping reviews do not require methodological assessment,[31] so critical appraisal will

262 not be conducted. The results of the study selection will be reported and presented in a PRISMA

263 2020 flow diagram.[42]

Data extraction

265   Two reviewers will independently extract and chart data. The data extraction tool will be

266 pilot tested with five studies to ensure consistency and assess the need for modification of the

267   tool. Any modification of the tool will be reported in the full report. See Supplementary File I for

268   the draft version of data extraction tool. Data will be extracted by two independent reviewers to

269   capture the following information: General characteristics of the paper (title, year, author,

270   country of origin, and design), description and characteristics of clinical settings, geography,

271   characteristics of participating clinicians, ICT-based intervention descriptions and characteristics,

272   target patient population, clinician-reported barriers and facilitators to implementing ICT-based

273   interventions, reported measures, outcomes, and direction of effectiveness. Any discrepancies in

274   data extraction will be resolved either through discussion between the two reviewers or by a third

275   reviewer. Lastly, authors will be contacted to request for missing or additional information when

276   appropriate.

277   **Data analysis**

278   Following data extraction, this review will characterize extracted data using frameworks,

279   typology, and taxonomies to address the proposed review questions. Data coding strategy will be

280   pilot tested and assessed for further modification. After finalizing the coding strategy, the

281   primary reviewer will code the rest of the data, and then the second reviewer will verify the

282   coded data. Any disagreements that arise between the reviewers will be resolved either through

283 discussion or by a third reviewer. Data coding is expected to be an iterative process; therefore,

284 any necessary changes to the coding strategy will be made and reported in the full review.

285 *Characteristics of ICT-based interventions (Question1)*

286   Identified ICT-based interventions will be categorized using typology created by the

287 Mental Health Commission of Canada.[43] Then interventions will be categorized into the three

288 levels of suicide prevention following the descriptions provided by the WHO [38]:1) Universal

289 (entire population); 2) Selective (specific subpopulations, targeting vulnerable populations); 3)

290 Indicated (high-risk individuals, displaying signs of suicide potential).

291 *Barriers and facilitators to implementing ICT-based interventions in clinical settings (Question*

292 *1.1)*

293   This review will perform directed content analysis[44] to describe clinician-reported barriers

294 and facilitators to implementing ICT-based interventions within the COM-B and TDF. This

295 review is part of a multi-phase project to develop and test tailored implementation strategies for a

296 mobile app-based suicide prevention in a clinical setting. Lynch and colleagues [45] advice on

297 selecting theory for implementation projects, and suggest the use of COM-B and TDF when

298 researchers are investigating individual experiences as a preparation for implementation. As

299   such, the authors made evidence-informed decision to utilize COM-B and TDF. Both COM-B[23]

300   and TDF[24] are comprehensive and evidence-based behaviour frameworks that capture internal

301   and external influences on an individual's behaviour change. Furthermore, COM-B and TDF

302   have been previously used across healthcare disciplines to assess implementation problems and

303   to provide theory-informed suggestions for implementation.[46–48] In the current scoping review,

304   narrative descriptions of barriers and facilitators will be coded onto the most appropriate

305   domains of COM-B and TDF. Coded barriers and facilitators will serve as a knowledge base in

306   future research, informing the strategic selection of theory-based strategies for implementation

307   that can overcome barriers and leverage facilitators.

308   *Reported measures and outcomes (Question 1.2)*

309   This review will categorize reported measures and outcomes using the Effective Practice

310   and Organisation of Care (EPOC) taxonomy [49] and outcomes of evidence-based practice

311   measures.[50] Outcomes will be categorized into three levels: 1) Patient, 2) Health care provider, 3)

312   Health system. Patient level outcomes will be further distinguished to patient-reported outcomes

313   (e.g., symptoms),[51] patient-reported experience (e.g., satisfaction),[52] and patient health outcomes

314   (e.g., mortality).[49] Examples of health care provider outcomes include knowledge, attitude (e.g.,

315 satisfaction and acceptability), and behaviour (e.g., practice changes noted in medical charts).[50]

316 Examples of system level outcomes include resource utilization (e.g., length of stay and number

317 of admission) and economic outcomes (e.g., cost effectiveness). [49]

Data presentation

319   This review will present the charted data in tables that align with the review objectives.

320 Descriptive numerical summaries of the quantitative data (e.g., frequency counts for barriers and

321 facilitators) will be provided where possible. Lastly, narrative descriptions will accompany these

322 presentations and describe how the findings address the review questions.

Public and patient involvement

324   The authors plan to discuss the review findings and request feedback from the Suicide

325 Prevention Working Group and the clinical patient and family advisory committees at the Centre

326 for Additions and Mental Health (CAMH) for the next step of this work. During engagement

327 meetings, these groups can identify research priorities to inform the next steps. Also, these

328 groups will be invited to contribute to the dissemination plan.

Ethics and dissemination

330   This scoping review is aimed at synthesizing information from the existing literature;

331   therefore, ethics approval is not required. This scoping review is part of a multi-phase project to

332   develop and test tailored implementation strategies for a mobile app-based suicide prevention

333   intervention in a clinical setting. The findings will directly inform the subsequent phase to

334   identify strategies to overcome barriers and leverage facilitators to maximize implementation.

335   Furthermore, authors anticipate that the findings will inform future research directions for other

336   ICT implementation efforts in clinical settings. As such, authors will share the results in a peer-

337   reviewed, open access publication, and conference presentations. Furthermore, the findings will

338   be shared with relevant health organizations (e.g., CAMH) through lay language summaries and

339   informal presentations.

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Supplementary File I. Draft of data extraction tool

General characteristics of the paper
Title
Year
Author
Country of origin
Design

Clinical setting
Description of clinical setting
Type
☐ In-patient ☐ Out-patient (clinics) ☐ Not reported
Geography
☐ Urban ☐ Suburban ☐ Rural ☐ Mixture ☐ Not reported

Clinicians
Characteristics (sample demographic information including gender, age, years of clinical experience)
Discipline

ICT intervention characteristics
ICT intervention description

ICT type		
Target patient population of ICT intervention		
Implementation		
Reported barriers		
Reported facilitators		
Measures and outcomes		
Measures		
Outcomes		
Direction of effectiveness		
☐ Positive ☐ Negative ☐ Neutral		

Supplementary File II. Search strategy for Medline (Ovid)

Ovid MEDLINE: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid
MEDLINE® Daily and Ovid MEDLINE® <1946-Present>

Date searched: August 5, 2021

Line	Query	Records Retrieved
1	information technology/	526
2	software/	115757
3	mobile applications/	8314
4	programming languages/	4242
5	software design/	6049
6	user-centered design/	56
7	user-computer interface/	38389
8	web browser/ or word processing/	1854
9	exp electronics/	39315
10	digital technology/	231
11	exp computer simulation/	259020
12	virtual reality/	3179
13	video games/	6170
14	electronic mail/	2801
15	cell phone/ or smartphone/	15430
16	text messaging/	3606
17	wireless technology/	3917
18	algorithms/	271596
19	exp artificial intelligence/	119797
20	exp expert systems/	3435
21	exp fuzzy logic/	4761
22	exp knowledge bases/	10539
23	exp machine learning/	30945
24	exp natural language processing/	4870
25	exp neural networks, computer/	36200
26	exp robotics/	31801
27	social media/	10856
28	exp internet/	86620
29	((mobile or online or web or internet) adj3 (application* or app or apps or interface* or platform* or program* or tech* or intervention*)).tw,kf.	43178

30	(smartphone* or smart phone* or tablet or cellphone or cell phone or mobile phone).tw,kf.	52887
31	Text messag*.tw,kf.	4950
32	(e-health or ehealth or m-health or mhealth).tw,kf.	13877
33	(social media* or social network* site* or social network* website* or facebook* or instagram* or snapchat* or Linkedin* or Weibo* or Whatsapp* or Whats app* or Telegram* or WeChat* or We Chat* or tiktok*).tw,kf.	21644
34	((twitter* or tweet*) not tweetable abstract).tw,kf.	4846
35	(forum* adj3 (internet or web* or chat*)).tw,kf.	679
36	PatientsLikeMe.tw,kf.	68
37	wiki*.tw,kf.	1574
38	algorithm*.tw,kf.	285739
39	(artificial intelligence or "AI" or "A.I.").tw,kf.	42342
40	computational intelligence.tw,kf.	341
41	(machine learning or deep learning or natural language processing).tw,kf.	65991
42	(information adj3 technolog*).tw,kf.	21183
43	(communication* adj3 technolog*).tw,kf.	6753
44	or/1-43	1075973
45	suicide/ or suicidal ideation/ or suicide, attempted/ or suicide, completed/	61461
46	(suicid* adj3 prevent*).tw,kf.	8262
47	(suicid* adj3 (attempt* or commit* or complet* or die* or dead or ideation* or thought* or plan* or consider* or contemplat* or behavio?r* or method*)).tw,kf.	41228
48	suicidal*.tw,kf.	35112
49	self-injurious behavior/ or self mutilation/	11622
50	(selfharm* or self-harm or selfinjur* or self-injur* or selfinflict* or self-inflict* or self-mutilat* or selfmutilat* or selfpoison* or self-poison* or automutilat*).tw,kf.	16663
51	((fatal* or lethal* or intentional* or deliberate*) adj2 (dose or doses or dosing or overdos* or self-administ* or selfadminist*)).tw,kf.	14134
52	or/45-51	107361
53	practice patterns, dentists'/ or practice patterns, nurses'/ or practice patterns, physicians'/	68628

54	"delivery of health care"/	98968
55	"delivery of health care, integrated"/	13510
56	patient care management/	4586
57	health services accessibility/	79884
58	managed care programs/	24335
59	telemedicine/	29438
60	exp Health Facilities/	824890
61	(clinical* adj3 (practice* or practise* or application* or care)).tw,kf.	361453
62	((health or healthcare or medical or psychiatr* or mental* or rehab* or treatment* or inpatient* or outpatient* or walk-in or drop-in) adj3 (hospital* or institut* or setting* or environment* or clinic* or centre* or center* or facility or facilities or ward* or unit* or office* or program* or service* or intervention*)).ti,ab,kf,hw.	1507381
63	(clinical adj3 (hospital* or institut* or setting* or environment* or centre* or center* or facility or facilities or ward* or unit* or office* or program* or service* or intervention*)).ti,ab,kf,hw.	180802
64	(care team* or healthcare team* or health team*).tw,kf.	20197
65	((health* or healthcare or medical* or mental* or psychiatr* or inpatient* or outpatient*) adj3 (session* or appointment*)).tw,kf.	6115
66	((nurse* or nursing) adj3 (hospital* or institut* or setting* or environment* or clinic* or centre* or center* or facility or facilities or ward* or unit* or office* or program* or service* or intervention* or care)).ti,ab,kf,hw.	219074
67	medical home*.tw,kf.	3555
68	hospital*.tw,kf.	1412419
69	(emergency adj3 (department* or ward* or unit* or room* or service* or medicine or center* or centre* or clinic or clinics or hospital* or care or visit* or patient*)).tw,kf.	183200
70	(casualty adj1 (department* or ward* or unit* or room* or service* or medicine or center* or centre* or clinic or clinics or hospital* or visit* or patient*)).tw,kf.	969
71	"a&e".tw,kf.	25944
72	("ER" or "E.R.").ti.	11351

73	(telemental* or tele mental* or teletherap* or telepsych* or telemedic* or telehealth* or teleconferenc* or tele-psychotherap* or tele-psychiatr* or tele-medic* or tele-health* or tele-conferenc*).tw,kf.	27435
74	((health* or healthcare or medical* or mental* or psychiatr*) adj3 (profession* or work* or practitioner* or provider* or clinician* or servic*)).tw,kf.	520573
75	(physician* or doctor* or primary care or general practitioner* or nurse practitioner*).tw,kf.	657819
76	(psychiatrist* or psychologist*).tw,kf.	40856
77	((health* or medic* or clinic*) adj3 (aide* or assistant* or technician* or navigator*)).tw,kf.	8671
78	(peer* adj3 (worker* or coach* or navigator*)).tw,kf.	1025
79	(digital adj3 (coach* or navigator*)).tw,kf.	64
80	((regulated or unregulated) adj3 (provider* or professional* or worker*)).tw,kf.	217
81	(treatment* or intervention*).ti,hw.	2333083
82	(allerg* or immunolog* or anesthesiolog* or dermatolog* or radiolog* or emergency medicine or family medicine or internal medicine or internist* or neurology* or obstetric* or gynecolog* or ophthalmolog* or pathology or pathologist* or pediatric* or paediatric* or oncolog* or surgeon* or surgical* or surgery or urolog*).tw,kf.	3759156
83	(social work* or occupational therap* or allied health* or pharmacy or pharmacist* or physiotherap* or dentist* or dental* or audiolog* or speech patholog* or language patholog* or chiropod* or podiatr* or chiropract* or dentur* or dietician* or dietetic* or homeopath* or naturopath* or kinesiolog* or massage therap* or midwif* or midwiv* or optician* or optometr* or psychotherap* or psycho-therap* or respiratory therap* or chinese medicine or acupunctur* or (laborator* adj3 (technolog* or technician*)) or ((radiation or radiolog*) adj3 (technolog* or technician*))).tw,kf.	624264
84	or/53-83	8628673
85	44 and 52 and 84	1323

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Information and communication technology-based interventions for suicide prevention implemented in clinical settings: A scoping review protocol

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Manuscripts

1   Information and communication technology-based interventions for suicide prevention

2   implemented in clinical settings: A scoping review protocol

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28

29 *Conflicts of Interest*

30 There are no conflicts of interest to declare with this submission.

31

32 *Word count*

33 2938

34 *Funding*

35 No funding was received for this review.

36

37 *Contributors*

38 HDS designed the scoping review protocol including data collection and interpretation planning.

39 HDS drafted the protocol. TR is a librarian and revised methods for search strategy and

40 developed final search strategy. HDS, JZ, TR, JT, GS revised the protocol for intellectual content

41 and made a final approval for the submission of the protocol.

42   **Information and communication technology-based interventions for suicide prevention**

43   **implemented in clinical settings: A scoping review protocol**

44   **Abstract**

45   **Introduction**

46   There is a surplus of Information and Communication Technology (ICT)-based interventions for

47   suicide prevention. However, it is unclear which of these ICT-based interventions for suicide

48   prevention have been implemented in clinical settings. Furthermore, evidence shows that

49   implementation strategies have often been mismatched to existing barriers. In response, the

50   authors recognize the critical need for prospectively assessing the barriers and facilitators and

51   then strategically developing implementation strategies. This review is part of a multi-phase

52   project to develop and test tailored implementation strategies for mobile app-based suicide

53   prevention in clinical settings. The overall objective of this scoping review is to identify and

54   characterize ICT-based interventions for all levels of suicide prevention in clinical settings.

55   Additionally, this review will identify and characterize the barriers and facilitators to

56   implementing these ICT-based interventions as well as reported measures and outcomes. The

57   findings will directly inform the subsequent phase to maximize implementation and inform

58 future efforts for implementing other types of ICT-based interventions related to suicide

59 prevention in clinical settings.

Methods and Analysis

61 This review will adhere to the methods described by the Joanna Briggs Institute for conducting

62 scoping reviews. The reporting will follow the Preferred Reporting Items for Systematic

63 Reviews and Meta-Analysis extension for scoping reviews checklist. The following databases

64 will be searched: Medline, PsycInfo, Embase, CINAHL, Web of Science, and LISTA. Two

65 reviewers will independently screen the articles and extract data using a standardised data

66 collection tool. Then, authors will characterize extracted data using frameworks, typology, and

67 taxonomies to address the proposed review questions.

Ethics and Dissemination

69 Ethics approval is not required for this scoping review. Authors will share the results in a peer-

70 reviewed, open access publication, and conference presentations. Furthermore, the findings will

71 be shared with relevant health organizations through lay language summaries and informal

72 presentations.

73 **Strengths and Limitations of this study**

74 • A rigorous scoping review method described by the Joanna Briggs Institute will be followed

75 and the full report will be developed using the Preferred Reporting Items for Systematic

76 Reviews and Meta-Analysis extension for scoping reviews checklist.

77 • This will be the first scoping review to map out the clinician-reported barriers and

78 facilitators to implement ICT-based interventions for suicide prevention in clinical settings.

79 • This scoping review has limitations regarding the number of databases and non-English

80 publication languages, which may limit research from low income and middle-income

81 countries.

82 • The list of barriers and facilitators will be limited to what is reported in the existing

83 literature; therefore, the research team aims to conduct a follow-up qualitative research to

84 better investigate and contextualize barriers and facilitators in a specific clinical context.

85 • Since the purpose of this scoping review is to map and characterize the evidence, there will

86 not be critical appraisals to determine the quality of individual studies to assess the risk of

87 bias.

88   **Introduction**

89   Globally, 800,000 people die by suicide every year, which translates to 11 deaths per

90   day.[1] In Canada, suicide is currently the second leading cause of death among youth and young

91   adults.[2] Furthermore, the service utilization for those experiencing suicidal thoughts and

92   behaviours has been increasing for many years. At a national level, the number of emergency

93   department visits related to suicide-related thoughts and behaviours has doubled among youth

94   between 2007 to 2015 in the USA.[3] Similarly, in Australia, the numbers have tripled among

95   patients of all ages from 2009 to 2018 in two emergency departments.[4] Suicide prevention is a

96   top research priority globally, as reflected in the United Nations Sustainable Development Goals

97   for 2030.[5]

98   The current COVID-19 pandemic has brought a significant impact on psychological

99   health, further contributing to the increased need for suicide prevention services.[6] Furthermore,

100   there has been poorer access to mental health services since the onset of pandemic.[7] One

101   recommendation to meet this unprecedented, increased need for mental health care is to reform

102   the system and re-distribute services and resources from tertiary care centres to community and

103   primary care.[8] Technological integration between primary, community and tertiary mental health

104   is one adaptable response.[9] For example, innovative tools, such as telehealth tools, have been

105   rapidly implemented in community mental health services internationally, allowing continuity of

106   care.[7] As such, COVID-19 pandemic has accelerated the implementation of digital solutions,[10]

107   and this momentum can be leveraged to re-distribute mental health care via innovative means to

108   provide appropriate suicide prevention care to patients at the right time.

109   Information and communication technology (ICT) is defined as "a set of technologies

110   resulting from the convergence of information technology and advanced multimedia and

111   telecommunications techniques, which have enabled the emergence of more efficient means of

112   communication, by improving processing, storage, distribution and exchange some

113   information."[11] ICTs are also referred to as eHealth by the World Health Organization (WHO),[12]

114   and examples include, but are not limited to, Internet and mobile technologies. There is a surplus

115   of ICT-based interventions for mental health care, including suicide prevention.[13,14] For example,

116   there are 38 mental health apps available from the Google Play Store (Android) and Apple App

117   Store, and 11 of them are comprised of in-app crisis resources such as safety planning

118   intervention (SPI).[15] Rassy and colleagues[14] have shown that ICTs for suicide prevention can

119   provide an interactive, personalized, and accessible way to reach various populations to identify

120   and provide care to the individuals at risk.[14] Although more additional higher quality,

121   randomized controlled studies are required, evidence to date shows promising outcomes of the

122   ICT-based interventions for suicide prevention, including high acceptability from the patients

123   and some beneficial effects on suicidal ideation.[16] In clinical settings, on the other hand, it

124   remains unknown which ICT-based interventions for suicide prevention have been implemented

125   and are being delivered by clinicians.

126   As of now, the SPI[17] is one best practice for suicide prevention, producing a 45%

127   reduction in suicidal behaviour compared to treatment as usual in the emergency department.[18]

128   More recently, systematic reviews have shown significant effects of SPI on reducing the risk of

129   suicide-related behaviours.[19,20] SPI is a collaborative process between clinicians and a patient for

130   developing a plan regarding coping strategies, emergency contacts, and lethal means

131   restriction.[17] As collaboration is a critical feature of SPI, clinicians play an important role in

132   creating a therapeutic alliance with patients and building trust. As such, ICTs cannot replace

133   clinicians in situations where clinical interaction is essential, yet ICTs can be embedded in

134   clinical settings to make effective interventions more widely accessible.[21] Furthermore,

135 integrating ICT-based interventions into routine care, which allows clinicians to provide

136 oversight to patients, can facilitate the adoption of these tools.[22]

137   To date, reviews have yet to comprehensively explore ICT-based interventions for

138 suicide prevention delivered in clinical settings. Furthermore, reviews have yet to assess barriers

139 and facilitators for implementing these ICT-based interventions for suicide prevention. Hence,

140 the overall objective of this scoping review is to identify and characterize ICT-based

141 interventions for all levels of suicide prevention in clinical settings. The secondary objectives of

142 this review are as follow: 1) identify and characterize the barriers and facilitators to

143 implementing these ICT-based interventions within the Capability, Opportunity, Motivation -

144 Behaviour (COM-B)[23] and the Theoretical Domains Framework (TDF)[24]; 2) identify reported

145 measures and outcomes in these studies.

146   This review is part of a multi-phase project to develop and test tailored implementation

147 strategies for mobile app-based suicide prevention in clinical settings. Implementation is a

148 known determinant of effectiveness, meaning barriers to implementation can significantly reduce

149 the effectiveness of interventions and lead to suboptimal outcomes.[25] Further, evidence shows

150 that implementation strategies have often been mismatched to existing barriers in a given

151   context.[26,27] For example, a review of 20 quality improvement studies found that many studies

152   utilized clinician-oriented (individual level) strategies, such as education, to address

153   organizational level barriers.[26] Theoretically speaking, education alone may be insufficient to

154   address external influences of implementation.[23] Specifically for mental health apps, there was a

155   recent call for attention to complex contexts in which apps are being implemented in order to

156   tailor facilitation.[28] As such, it is critical to prospectively assess the barriers and facilitators in the

157   organizational and local context and then strategically develop implementation strategies.[29] The

158   findings from this review will be used as a knowledge base for the subsequent phase to identify

159   strategies to overcome barriers and leverage facilitators to maximize implementation. The

160   findings can also inform future efforts to develop and test strategies for implementing other types

161   of ICT-based interventions related to suicide prevention in clinical settings.

162   A search of PROSPERO, the Cochrane Database of Systematic Reviews and Joanna

163   Briggs Institute (JBI) Evidence Synthesis and Open Science Framework was conducted in June-

164   July 2021, and no current or underway systematic reviews or scoping reviews on the topic were

165   identified.

166   **Research questions**

167   To achieve the research objectives stated above, this scoping review will address the following

168   questions.

169   1. What ICT-based interventions for suicide prevention have been implemented in clinical

170   settings?

171   1.1. What are the reported barriers and facilitators to implementing these ICT-based

172   interventions?

173   1.2. What are the reported measures and outcomes?

174   **Methods**

175   This review will adhere to the JBI methodology for scoping review,[30,31] and the Preferred

176   Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA-ScR) extension for

177   scoping reviews[32] will be used to guide the reporting. Major steps of our scoping review are: (1)

178   searching for relevant studies; (3) screening and selecting relevant studies; (4) extracting data;

179   and (5) summarizing and presenting key findings.

180   **Inclusion/exclusion criteria**

181   To identify relevant studies, key inclusion/exclusion criteria were constructed based on

182   the population, concept and context (PCC) mnemonic recommended by JBI.

183   *Participant*

184   In literature, a wide range of health care professionals who provide direct care in clinical

185   settings (e.g., physicians, nurses, nurse practitioners, physician assistants, social workers, and

186   medical resident) have been commonly referred to as 'clinicians'.[33,34] All types of clinicians who

187   are licenced and regulated practitioners will be included in this review. Furthermore, unregulated

188   practitioners or clinical support personnel, such as peer support workers, will be included in this

189   review. Therefore, ICT-based interventions must be implemented or delivered by these members

190   of the clinical team, and this review will exclude studies if a research assistant delivers an ICT-

191   based intervention. There will be no exclusion criteria based on gender, health care discipline,

192   and years of experience. Therefore, health care trainees, such as medical residents, will also be

193   considered for inclusion. Lastly, ICT-based interventions can target patient population of any age

194   and any levels of suicide prevention.

195   *Concept*

196   All literature that describes ICT-based interventions will be included in this review.

197   Following the definitions provided in the introduction, ICTs or eHealth include, but are not

198   limited to, computerized resources, mobile apps, and text messaging. Additionally, the definition

199   provided by the WHO will be adopted to identify interventions: "A health intervention is an act

200   performed for, with or on behalf of a person or population whose purpose is to assess, improve,

201   maintain, promote or modify health, functioning or health conditions."[35] Therefore, general use

202   of electronic health care records while caring for patients with suicidal ideation will be excluded

203   if there are no ICT-based interventions being implemented or delivered to patients. Additionally,

204   routine care (i.e., care as usual) provided via virtual platforms or telephones will be excluded

205   unless an ICT-based intervention is being delivered. ICT-based interventions can be delivered in-

206   person or other means of communication by clinicians. Crisis services (phone, chat, text) as are

207   appropriate response for suicide prevention. However, this review will exclude crisis services

208   since there has already been a systematic review investigating their effectiveness.[36] The current

209   review will use the umbrella term, suicide-related thoughts and behaviours,[37] which refers to a

210   spectrum of suicide-related ideation, communication, behaviours, and attempts with having

211   casual to persistent suicidal thoughts with actual, undetermined or no suicidal intent. ICT-based

212   interventions for suicide prevention regarding any sub-category of suicide-related thoughts and

213   behaviours will be included. Lastly, ICT-based interventions related to all levels of suicide

214   prevention following the WHO description (i.e., Universal, Selective, Indicated)[38] will be

215   included. See Table 1 for the list of suicide prevention interventions.

216   *Context*

217   All types of clinical settings, such as in-patient, emergency, ambulatory, and primary care,

218   will be considered for inclusion. For this review, a clinical setting is defined as any context

219   where clinician-patient interactions occur in real-time. To be included, ICT-based interventions

220   need to be implemented and initiated in the clinical setting. Self-support tools that patients can

221   freely download from app stores will be excluded as these are being initiated in non-clinical

222   settings. However, if app-based interventions or other forms of ICT-based interventions are

223   prescribed by clinicians or clinical support team, they will be included in the review. Please see

224   Table 1 for the summary of eligibility.

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225 **Table 1. Eligibility criteria**

	Inclusion Criteria	Exclusion Criteria
Population	All members of clinical care team • licenced and regulated practitioners • Unregulated practitioners or clinical support teams such as peer support workers All ages, genders, locations, and years of experience	Not a member of clinical care team
Topic	Information and Communication Technologies (ICTs): "A set of technologies resulting from the convergence of information technology and advanced multimedia and telecommunications techniques, which have enabled the emergence of more efficient means of communication, by improving processing, storage, distribution and exchange some information." [11] Suicide-related thoughts and behaviours[37]: represent a spectrum of suicide-related ideation, communication, behaviours and attempts with having casual to persistent suicidal thoughts with actual, undetermined or no suicidal intent. This review will consider ICT-based interventions for suicide prevention regarding any sub-category of suicide-related thoughts and behaviours.	No ICTs Crisis services (phone, chat, text) Care as usual

	Suicide Prevention Intervention Category (adapted from Wilson et al.[39] and Zalsman et al.[40]) • Screening and assessment • Safety plan (e.g., identifying warning signs coping strategies, emergency contacts) • Lethal means restriction and counselling • Discharge or post-discharge follow up • Behaviour or cognitive therapies	
Setting	Clinical/hospital setting or context (i.e., clinician-patient interaction in real time)	Not a clinical setting or context
Source	Primary research papers including in press papers. If literature reviews, commentaries, and opinion papers include relevant primary research studies, this review will include them in the screening phase then hand-search their references to identify the original papers that meet the inclusion criteria. Conference papers, reports from relevant health services organizations.	Books, theses, commentaries, opinion papers, literature reviews, preprints, abstracts
Type of study	All designs including study protocols	N/A
Language	English	non-English language

226 **Search strategy**

227   In collaboration with a health sciences librarian, a comprehensive search strategy will be

228   developed to locate relevant scholarly literature using multiple bibliographic databases. This

229   scoping review will follow a three-step search strategy outlined in JBI methodology.[31] First, we

230   will develop and refine a draft strategy in Medline, followed by an analysis of the text words

231   contained in titles and abstracts of relevant articles and the subject headings applied to them.

232   After revising, testing, and finalizing this search strategy, TR will translate the strategy using

233   database-specific subject headings, search fields, and operators, and run the search in each

234   included database. The search strategy will be peer-reviewed by a second research librarian using

235   the Peer Review of Electronic Search Strategy (PRESS) guidelines.[41] The proposed search

236   strategy for Medline (Ovid), peer-reviewed by a second research librarian, is presented in

237   Supplementary File I. Thirdly, the reference list of the sources that have been included in the

238   reviews will be hand-searched for additional articles.

239   The targeted Google search method outlined by Godin et al., 2015.[42] will be utilized to

240   identify a list of international and national health services' websites to locate reports and other

241   eligible sources. The first step involves conducting ten unique Google searches with different

242   combinations of keywords and reviewing the first 100 items of each search to identify relevant

243 websites. The second step involves hand-searching identified relevant websites to find reports or

244 other sources that meet the inclusion criteria. This targeted Google search will complement the

245 database searches to identify more diverse sources of evidence.

246 **Types of sources**

247   The following databases will be searched for relevant studies: Medline, APA PsycInfo,

248 Embase, the Cumulative Index to Nursing & Allied Health Literature (CINAHL), Web of

249 Science, and Library, Information Science & Technology Abstracts (LISTA). All types of

250 research designs will be included (e.g., quantitative, observational, qualitative, and mixed

251 methods). Although study protocols do not have empirical data, we will include them and

252 capture relevant details and reflect the upcoming trends. By doing so, we will be able to provide

253 a comprehensive breadth of information that is currently available. Reference lists of relevant

254 literature reviews, commentaries, text and opinion papers will be reviewed to identify additional

255 primary research papers that meet the eligibility criteria. Grey literature including conference

256 papers, reports and publications by relevant national and international websites of health

257 organizations and agencies will be included. Sources written in English will be included, and no

258 date parameters will be applied.

259 **Study selection**

260   All identified citations will be collated and uploaded into Covidence[43] and duplicates will

261 be automatically removed. Two reviewers will independently screen titles and abstracts against

262 the inclusion and exclusion criteria. Next, relevant full-text articles will be retrieved into

263 Covidence,[43] and two independent reviewers will assess the full-text of relevant studies in detail

264 against the eligibility criteria. Reasons for exclusion will be recorded at the full-text screening

265 phase and will be reported in the full review. Any discrepancies between the reviewers at each

266 stage of the study selection process will be resolved either through discussion or by a third

267 reviewer. Scoping reviews do not require methodological assessment,[31] so critical appraisal will

268 not be conducted. The results of the study selection will be reported and presented in a PRISMA

269 2020 flow diagram.[44]

270 **Data extraction**

271   Two reviewers will independently extract and chart data. The data extraction tool will be

272 pilot tested with five studies to ensure consistency and assess the need for modification of the

273 tool. Any modification of the tool will be reported in the full report. See Supplementary File II

274 for the draft version of data extraction tool. Data will be extracted by two independent reviewers

275 to capture the following information: General characteristics of the paper (title, year, author,

276 country of origin, and design), description and characteristics of clinical settings, geography,

277 characteristics of participating clinicians, description and characteristics of implementation

278 strategies and ICT-based intervention(s), target patient population, clinician-reported barriers and

279 facilitators to implementing ICT-based interventions, reported measures, outcomes, and direction

280 of effectiveness. Any discrepancies in data extraction will be resolved either through discussion

281 between the two reviewers or by a third reviewer. Lastly, authors will be contacted to request for

282 missing or additional information when appropriate.

283 **Data analysis**

284   Following data extraction, this review will characterize extracted data using frameworks,

285 typology, and taxonomies to address the proposed review questions. Data coding strategy will be

286 pilot tested and assessed for further modification. After finalizing the coding strategy, the

287 primary reviewer will code the rest of the data, and then the second reviewer will verify the

288 coded data. Any disagreements that arise between the reviewers will be resolved either through

289 discussion or by a third reviewer. Data coding is expected to be an iterative process; therefore,

290 any necessary changes to the coding strategy will be made and reported in the full review.

291   *Characteristics of ICT-based interventions (Question1)*

292   Identified ICT-based interventions will be categorized using typology created by the

293   Mental Health Commission of Canada.[45] Then interventions will be categorized into the three

294   levels of suicide prevention following the descriptions provided by the WHO [38]:1) Universal

295   (entire population); 2) Selective (specific subpopulations, targeting vulnerable populations); 3)

296   Indicated (high-risk individuals, displaying signs of suicide potential).

297   *Barriers and facilitators to implementing ICT-based interventions in clinical settings (Question*

298   *1.1)*

299   This review will perform directed content analysis[46] to describe clinician-reported barriers

300   and facilitators to implementing ICT-based interventions within the COM-B and TDF. This

301   review is part of a multi-phase project to develop and test tailored implementation strategies for a

302   mobile app-based suicide prevention in a clinical setting. Lynch and colleagues [47] advice on

303   selecting theory for implementation projects, and suggest the use of COM-B and TDF when

304   researchers are investigating individual experiences as a preparation for implementation. As

305   such, the authors made evidence-informed decision to utilize COM-B and TDF. Both COM-B[23]

306   and TDF[24] are comprehensive and evidence-based behaviour frameworks that capture internal

307 and external influences on an individual's behaviour change. Furthermore, COM-B and TDF

308 have been previously used across healthcare disciplines to assess implementation problems and

309 to provide theory-informed suggestions for implementation.[48–50] In the current scoping review,

310 narrative descriptions of barriers and facilitators will be coded onto the most appropriate

311 domains of COM-B and TDF. Coded barriers and facilitators will serve as a knowledge base in

312 future research, informing the strategic selection of theory-based strategies for implementation

313 that can overcome barriers and leverage facilitators.

314 *Reported measures and outcomes (Question 1.2)*

315   This review will categorize reported measures and outcomes using the Effective Practice

316 and Organisation of Care (EPOC) taxonomy [51] and outcomes of evidence-based practice

317 measures.[52] Outcomes will be categorized into three levels: 1) Patient, 2) Health care provider, 3)

318 Health system. Patient level outcomes will be further distinguished to patient-reported outcomes

319 (e.g., symptoms),[53] patient-reported experience (e.g., satisfaction),[54] and patient health outcomes

320 (e.g., mortality).[51] Examples of health care provider outcomes include knowledge, attitude (e.g.,

321 satisfaction and acceptability), and behaviour (e.g., practice changes noted in medical charts).[52]

322   Examples of system level outcomes include resource utilization (e.g., length of stay and number

323   of admission) and economic outcomes (e.g., cost effectiveness). [51]

324   **Data presentation**

325   This review will present the charted data in tables that align with the review objectives.

326   Descriptive numerical summaries of the quantitative data (e.g., frequency counts for barriers and

327   facilitators) will be provided where possible. Lastly, narrative descriptions will accompany these

328   presentations and describe how the findings address the review questions.

329   **Public and patient involvement**

330   The authors plan to discuss the review findings and request feedback from the Suicide

331   Prevention Working Group and the clinical patient and family advisory committees at the Centre

332   for Additions and Mental Health (CAMH) for the next step of this work. During engagement

333   meetings, these groups can identify research priorities to inform the next steps. Also, these

334   groups will be invited to contribute to the dissemination plan.

335   **Ethics and dissemination**

336   This scoping review is aimed at synthesizing information from the existing literature;

337   therefore, ethics approval is not required. This scoping review is part of a multi-phase project to

338   develop and test tailored implementation strategies for a mobile app-based suicide prevention

339   intervention in a clinical setting. The findings will directly inform the subsequent phase to

340   identify strategies to overcome barriers and leverage facilitators to maximize implementation.

341   Furthermore, authors anticipate that the findings will inform future research directions for other

342   ICT implementation efforts in clinical settings. As such, authors will share the results in a peer-

343   reviewed, open access publication, and conference presentations. Furthermore, the findings will

344   be shared with relevant health organizations (e.g., CAMH) through lay language summaries and

345   informal presentations.

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Supplementary File I. Search strategy for Medline (Ovid)

Ovid MEDLINE: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid
MEDLINE® Daily and Ovid MEDLINE® <1946-Present>

Date searched: August 5, 2021

Line	Query	Records Retrieved
1	information technology/	526
2	software/	115757
3	mobile applications/	8314
4	programming languages/	4242
5	software design/	6049
6	user-centered design/	56
7	user-computer interface/	38389
8	web browser/ or word processing/	1854
9	exp electronics/	39315
10	digital technology/	231
11	exp computer simulation/	259020
12	virtual reality/	3179
13	video games/	6170
14	electronic mail/	2801
15	cell phone/ or smartphone/	15430
16	text messaging/	3606
17	wireless technology/	3917
18	algorithms/	271596
19	exp artificial intelligence/	119797
20	exp expert systems/	3435
21	exp fuzzy logic/	4761
22	exp knowledge bases/	10539
23	exp machine learning/	30945
24	exp natural language processing/	4870
25	exp neural networks, computer/	36200
26	exp robotics/	31801
27	social media/	10856
28	exp internet/	86620
29	((mobile or online or web or internet) adj3 (application* or app or apps or interface* or platform* or program* or tech* or intervention*)).tw,kf.	43178

30	(smartphone* or smart phone* or tablet or cellphone or cell phone or mobile phone).tw,kf.	52887
31	Text messag*.tw,kf.	4950
32	(e-health or ehealth or m-health or mhealth).tw,kf.	13877
33	(social media* or social network* site* or social network* website* or facebook* or instagram* or snapchat* or Linkedin* or Weibo* or Whatsapp* or Whats app* or Telegram* or WeChat* or We Chat* or tiktok*).tw,kf.	21644
34	((twitter* or tweet*) not tweetable abstract).tw,kf.	4846
35	(forum* adj3 (internet or web* or chat*)).tw,kf.	679
36	PatientsLikeMe.tw,kf.	68
37	wiki*.tw,kf.	1574
38	algorithm*.tw,kf.	285739
39	(artificial intelligence or "AI" or "A.I.").tw,kf.	42342
40	computational intelligence.tw,kf.	341
41	(machine learning or deep learning or natural language processing).tw,kf.	65991
42	(information adj3 technolog*).tw,kf.	21183
43	(communication* adj3 technolog*).tw,kf.	6753
44	or/1-43	1075973
45	suicide/ or suicidal ideation/ or suicide, attempted/ or suicide, completed/	61461
46	(suicid* adj3 prevent*).tw,kf.	8262
47	(suicid* adj3 (attempt* or commit* or complet* or die* or dead or ideation* or thought* or plan* or consider* or contemplat* or behavio?r* or method*)).tw,kf.	41228
48	suicidal*.tw,kf.	35112
49	self-injurious behavior/ or self mutilation/	11622
50	(selfharm* or self-harm or selfinjur* or self-injur* or selfinflict* or self-inflict* or self-mutilat* or selfmutilat* or selfpoison* or self-poison* or automutilat*).tw,kf.	16663
51	((fatal* or lethal* or intentional* or deliberate*) adj2 (dose or doses or dosing or overdos* or self-administ* or selfadminist*)).tw,kf.	14134
52	or/45-51	107361
53	practice patterns, dentists'/ or practice patterns, nurses'/ or practice patterns, physicians'/	68628

54	"delivery of health care"/	98968
55	"delivery of health care, integrated"/	13510
56	patient care management/	4586
57	health services accessibility/	79884
58	managed care programs/	24335
59	telemedicine/	29438
60	exp Health Facilities/	824890
61	(clinical* adj3 (practice* or practise* or application* or care)).tw,kf.	361453
62	((health or healthcare or medical or psychiatr* or mental* or rehab* or treatment* or inpatient* or outpatient* or walk-in or drop-in) adj3 (hospital* or institut* or setting* or environment* or clinic* or centre* or center* or facility or facilities or ward* or unit* or office* or program* or service* or intervention*)).ti,ab,kf,hw.	1507381
63	(clinical adj3 (hospital* or institut* or setting* or environment* or centre* or center* or facility or facilities or ward* or unit* or office* or program* or service* or intervention*)).ti,ab,kf,hw.	180802
64	(care team* or healthcare team* or health team*).tw,kf.	20197
65	((health* or healthcare or medical* or mental* or psychiatr* or inpatient* or outpatient*) adj3 (session* or appointment*)).tw,kf.	6115
66	((nurse* or nursing) adj3 (hospital* or institut* or setting* or environment* or clinic* or centre* or center* or facility or facilities or ward* or unit* or office* or program* or service* or intervention* or care)).ti,ab,kf,hw.	219074
67	medical home*.tw,kf.	3555
68	hospital*.tw,kf.	1412419
69	(emergency adj3 (department* or ward* or unit* or room* or service* or medicine or center* or centre* or clinic or clinics or hospital* or care or visit* or patient*)).tw,kf.	183200
70	(casualty adj1 (department* or ward* or unit* or room* or service* or medicine or center* or centre* or clinic or clinics or hospital* or visit* or patient*)).tw,kf.	969
71	"a&e".tw,kf.	25944
72	("ER" or "E.R.").ti.	11351

73	(telemental* or tele mental* or teletherap* or telepsych* or telemedic* or telehealth* or teleconferenc* or tele-psychotherap* or tele-psychiatr* or tele-medic* or tele-health* or tele-conferenc*).tw,kf.	27435
74	((health* or healthcare or medical* or mental* or psychiatr*) adj3 (profession* or work* or practitioner* or provider* or clinician* or servic*)).tw,kf.	520573
75	(physician* or doctor* or primary care or general practitioner* or nurse practitioner*).tw,kf.	657819
76	(psychiatrist* or psychologist*).tw,kf.	40856
77	((health* or medic* or clinic*) adj3 (aide* or assistant* or technician* or navigator*)).tw,kf.	8671
78	(peer* adj3 (worker* or coach* or navigator*)).tw,kf.	1025
79	(digital adj3 (coach* or navigator*)).tw,kf.	64
80	((regulated or unregulated) adj3 (provider* or professional* or worker*)).tw,kf.	217
81	(treatment* or intervention*).ti,hw.	2333083
82	(allerg* or immunolog* or anesthesiolog* or dermatolog* or radiolog* or emergency medicine or family medicine or internal medicine or internist* or neurology* or obstetric* or gynecolog* or ophthalmolog* or pathology or pathologist* or pediatric* or paediatric* or oncolog* or surgeon* or surgical* or surgery or urolog*).tw,kf.	3759156
83	(social work* or occupational therap* or allied health* or pharmacy or pharmacist* or physiotherap* or dentist* or dental* or audiolog* or speech patholog* or language patholog* or chiropod* or podiatr* or chiropract* or dentur* or dietician* or dietetic* or homeopath* or naturopath* or kinesiolog* or massage therap* or midwif* or midwiv* or optician* or optometr* or psychotherap* or psycho-therap* or respiratory therap* or chinese medicine or acupunctur* or (laborator* adj3 (technolog* or technician*)) or ((radiation or radiolog*) adj3 (technolog* or technician*))).tw,kf.	624264
84	or/53-83	8628673
85	44 and 52 and 84	1323

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Supplementary File II. Draft of data extraction tool

General characteristics of the paper
Title
Year
Author
Country of origin
Design

Clinical setting
Description of clinical setting
Type
☐ In-patient ☐ Out-patient (clinics) ☐ Not reported
Geography
☐ Urban ☐ Suburban ☐ Rural ☐ Mixture ☐ Not reported

Clinicians
Characteristics (sample demographic information including gender, age, years of clinical experience)
Discipline

Implementation strategy(s) characteristics
Implementation strategy description

ICT intervention characteristics	
ICT intervention description	
ICT type	
Target patient population of ICT intervention	
Implementation	
Reported barriers	
Reported facilitators	
Measures and outcomes	
Measures	
Outcomes	
Direction of effectiveness	
☐ Positive ☐ Negative ☐ Neutral	